



# STEM KIT

BUILD & LEARN  
**GUIDE**

SEED SCIENCE



SUSTAINABLE  
MATERIAL



NO GLUE  
OR MESS



SAFE AND  
EASY USE



STEMi  
AUTOMATED

## PROJECT OVERVIEW

For this project, students will be able to watch the entire life cycle of a pea plant. Students will be able to plant a seed and assist in keeping the plant going on its life cycle. This kit includes a rain cloud for water and a grow light for sunlight. Students will be able to observe the growth of their plant through a root-viewing window. Students will also learn about agricultural practices, what makes a plant a plant, and the process of photosynthesis.

## SAFETY WARNINGS:

**Please read all safety warnings before use:**

**Choking Hazard:** Small parts not for children under 6 years or any individual who have a tendency to place inedible objects in their mouths.

Do not allow water near a power socket or electrical plug.

Adult supervision required.

## MATERIALS

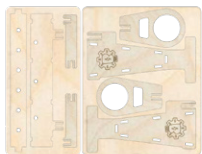
Durable wooden construction pieces  
Plexiglass panel  
Plant grow LED strip  
Peet pellets & Pea seeds  
Syringe & Tubing  
Short tubing  
Barb End Plug  
T-Connectors  
Luer Adapter  
Foil Ramekin  
O-Ring fastener  
Zip tie



## PARTS

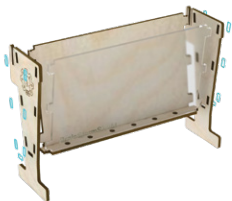


1



**Note:** If you can not break out a piece(s) by hand, use a small tool or screwdriver to punch and press them out. If you have no experience with tools, get help from an adult or someone with experience. If there are any burrs, points or rough spots do to breaking or cutting, smooth them with a piece of sand paper.

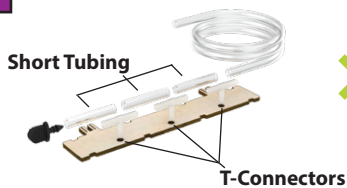
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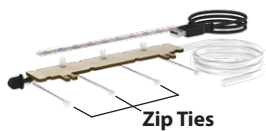
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6



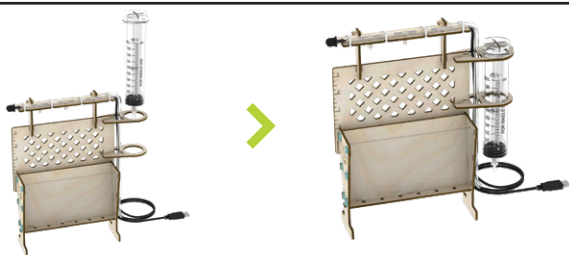
7



8



9



10



11



12



13

Fill with water



## HOW TO USE

Plant Seeds

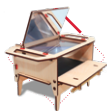


Press down to  
water plants

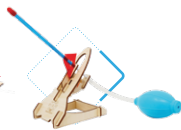
Fill with water

Plug in

*If you enjoyed this STEM Kit, check out some of our other Kits!*



SOLAR  
OVEN



AIR-POWERED  
ROCKET



EARTHQUAKE  
ENGINEER



AND MORE!



# TERMINOLOGY

**Germination** - the beginning growth of a seed into a seedling

**Seedling** - a young plant, grown from a seed

**Sprout** - a part of a plant that has just begun to grow

**Agriculture** - the science or art of cultivating the soil, growing crops, or raising livestock.

**Sustainable** - making sure the needs of the current generation are fulfilled, without putting future generations at risk, and while also maintaining a balance between the environment, the economy, and personal well-being.

**Irrigation** - the application of water to soil through the use of pumps, tubes, and/or hoses.

**Photosynthesis** - the process by which plants, and some other organisms, take in water and carbon dioxide, and convert it into food when exposed to sunlight

**Pollination** - The process of transferring pollen from the male portion of the flower (anther) to the female portion of the flower (stigma).

**Pollen** - a fine dust produced by plants that is carried to other plants of the same kind by the wind or by insects, so that the plants can reproduce

**Roots** - the underground parts of a plant, without leaves, that absorb water and minerals, stores food, and keeps the plant in place

**Stem** - main stalk of a plant that grows buds and shoots, and usually grows above ground

**Calyx** - the green outer part of a flower, consisting of sepals

**Leaves** - the often green, blade-like structure, at the end of a stem, on a vascular plant.

**Bud** - A small portion of a plant that develops into a flower, leaf, or shoots.

**Anther** - portion of the stamen that contains pollen.

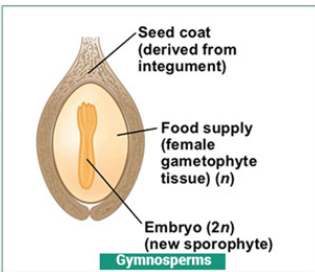
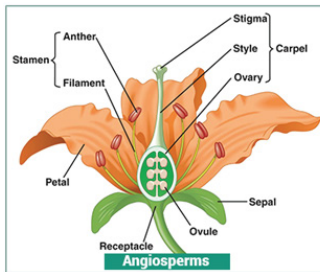
**Chlorophyll** - green material that allows plants to create their food through the conversion of carbon dioxide

**Angiosperms** - any plant that produces flowers, fruits, and seeds.

**Gymnosperms** - a close relative of angiosperms, these are plants that produce seeds, but no fruit or flowers.

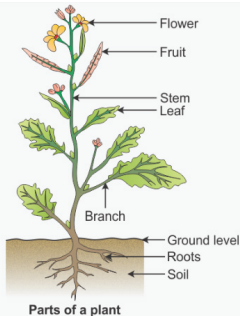
# WHAT IS A PLANT?

A plant is a living organism. Plants grow, develop, and reproduce. Nearly all plants make their food through a process called photosynthesis. Although there are many types of plants, there are two main categories they may fall into: vascular plants and nonvascular plants. Vascular plants contain tissues that transport materials through the plant, such as water. Vascular plants can be broken up into three groups: angiosperms, gymnosperms, ferns, and lycophytes. Angiosperms are plants that produce seeds, flowers, and fruits. Gymnosperms are plants, close relatives of angiosperms, that produce seeds, but no flowers or fruits. Ferns and lycophytes are woody plants that do not produce seeds, flowers, or fruits. Nonvascular plants are typically small and use diffusion and osmosis to transport material through the plant. An example of a nonvascular plant would be moss. Nearly all land plants are rooted in one location - some can direct their leaves toward sunlight and some can respond to touch.



## PLANT STRUCTURE

Each portion of a plant has a specific task to keep it alive. Vascular plants typically consist of three main parts: the leaves, the stem, and the roots. The leaves of a plant can collect sunlight and carbon dioxide. The stem of a plant is the main portion. It supports the plant, and the tissues inside it are used to transport nutrients and material throughout the plant. The roots of a plant keep it in one place and sturdy. Roots also soak up nutrients and water from the soil.

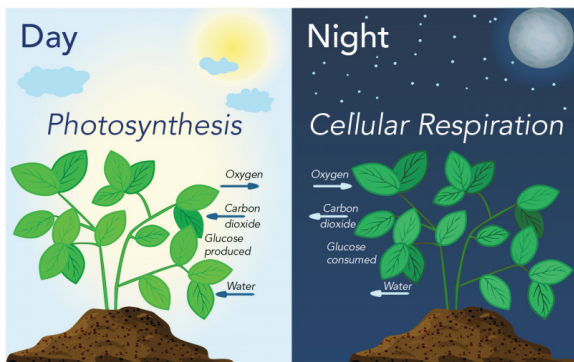


# PHOTOSYNTHESIS

Plants get their energy, in the form of sugar, from a process called photosynthesis. Photosynthesis is a process that takes solar energy (sunlight), water, and carbon dioxide and converts it into sugars (glucose) and oxygen. The chemical process of photosynthesis occurs in a plant's chloroplasts. Chloroplasts are within the plant's cells and contain chlorophyll, a light-absorbing chemical. Plants will often link together molecules of glucose and store them as starch. Starch is a very important form of energy. The process of photosynthesis doesn't just give the plant the energy it needs to grow, but it also is the basis for our food chain.

When the ingredients for photosynthesis are unavailable, plants will use the products of photosynthesis to go through a process called cellular respiration. Cellular respiration takes oxygen and glucose to create high-energy molecules. These molecules are used so that the plant may do the work it needs to live. The product of cellular respiration is carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ). These products must be able to move in and out of the plant. In young plants, these products are released through pores on the underside of the leaves, called stomates. On some other plants, these products move through sponge-like layers of cells called lenticels.

No matter whether it be photosynthesis or cellular respiration, there are always ingredients needed, products created, and the drive to keep the plant growing and developing.



# PLANT LIFE CYCLE

Plants have four main life stages.

1. Germination
2. Growth
3. Reproduction
4. Pollination

Each stage provides the plant with what it needs to complete its life cycle.

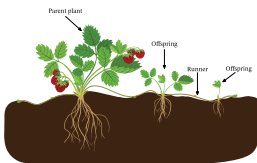
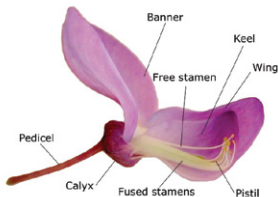
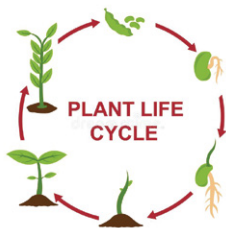
The germination stage is when the seed begins to sprout from the soil. The roots are beginning to develop, and the stem and leaves are starting to grow.

The next stage, the growth stage, focuses on the sprout developing into an adult plant. A good portion of the plant's life is spent in this cycle, as it matures.

Once it reaches its adult size, it is time for the reproduction stage. During this stage, the plant will release pollen, which contains the male reproductive cells. These reproductive cells are located on the male portion of the flower, called the stamens.

As the pollen is released, it travels by wind or by insect (such as a bee), to reach the female reproductive cells. The female portion of the plant is called the pistil. This movement of pollen to reach the female reproductive cells is called pollination.

Once the male and female reproductive cells meet, fertilization occurs, creating a zygote. Once the zygote matures, it will become a seed, and eventually be released by the plant, to create a new plant. Some plants do not participate in the pollination stage and their whole life cycle at the reproduction stage. These plants grow a new root system or shoot, making a clone of themselves as a new plant.



# AGRICULTURAL PRACTICES

**IRRIGATION** is when water is applied to an area through the use of tubes, pumps, or sprayers. This technique for watering crops is used in areas where there is either little to no rain, an area is going through a drought, or the area is dry. Irrigation practices are good for other areas as well, as farmers may only get a certain amount of water, and must use it wisely. The sources of water used in irrigation practices includes. rivers and lakes, springs and wells, and even treated wastewater. There are multiple types of irrigation practices, like surface irrigation, where the water is moved by gravity, or center pivot irrigation, where water is distributed through sprinklers, on top of towers, where they then move in a circular motion.



**SUSTAINABLE AGRICULTURE** is a type of agriculture that seeks to preserve the environment, use the Earth's resources wisely, and improve overall soil quality. Sustainable agriculture also seeks to improve profitable farm income, improve farm families and communities, and increase the production of human food and fiber needs. Each practice seeks to create a system for plant and animal production that will meet certain long-term goals. These long-term goals include providing enough agricultural products to meet demand and need, environment protection and expansion of the natural resource supply, and keeping up with the promotion of the agricultural economy.



## ACTIVITY FOR PROJECT

The Brainstorm planter kit can be used to grow and observe a plant. If you would like the planter to be used in a more engaging classroom activity, it can be paired with the provided worksheets. There are both beginner and advanced worksheets to adjust to the level of your student's understanding.

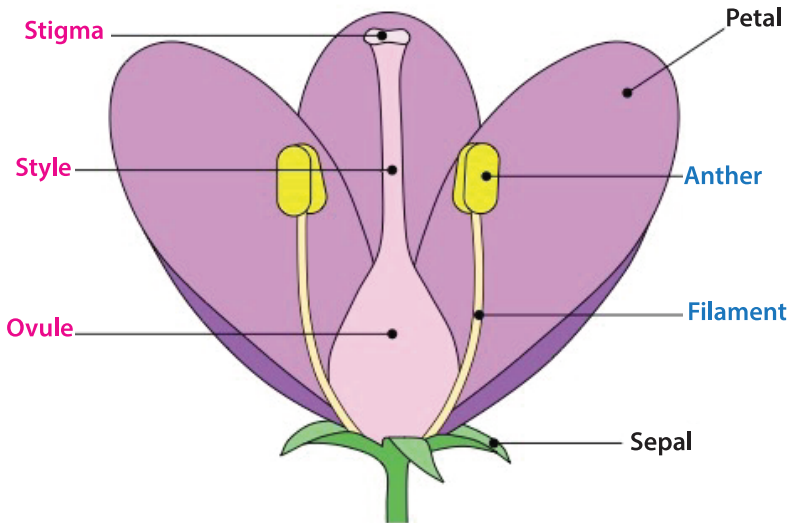
The planter will allow students to view the growth and life cycle of a plant. It will also allow students to control the amount of light and water the plant will receive. Students will be able to document each stage of growth for their plant and find what works best for their plant's growth.



Each of the worksheets is geared towards having the students identify plant life cycle stages. Each worksheet also discusses photosynthesis and what a plant needs to grow. On the beginner worksheet, students will draw and identify three life cycle stages, as well as identify what a plant needs to complete photosynthesis. On the advanced worksheet, students will label portions of a flower, describe how nonvascular plants get their water and nutrients, and draw the process of pollination.

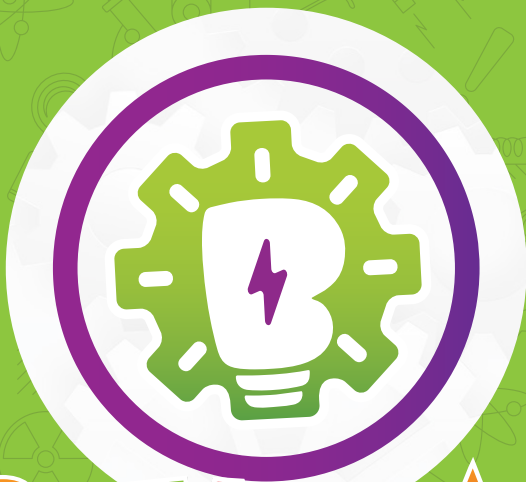
Students will be able to see how changing the amount of water and light will affect their plants.

## VISUAL FLOWER LABELING



**PISTIL**  
The FEMALE parts  
of the flower

**STAMEN**  
The MALE parts  
of the flower



# STEM KIT

SEED SCIENCE BUILD & LEARN BOOKLET

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 **STEM EDUCATION**

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